

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BOARD OF PATENT APPEALS AND INTERFERENCES**

In Re Application of:  
Yi-Cheng Liu

Serial No.:  
10/820,410

Filed:  
April 8, 2004

For:  
**Process Scheduling System and  
Method**

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Group Art Unit: 2169  
Examiner: Spieler, William  
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**APPEAL BRIEF PURSUANT TO 37 C.F.R. § 41.37**

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Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

This Appeal Brief under 37 C.F.R. § 41.37 is submitted in response to the Notice of Panel Decision from Pre-Appeal Brief Review mailed February 24, 2009, and in further support of the Notice of Appeal filed on January 26, 2009.

**I. REAL PARTY IN INTEREST**

The real party in interest of the instant application is Taiwan Semiconductor Manufacturing Co., Ltd., having its principal place of business at No. 8, Li-Hsin Rd., 6, Science-Based Industrial Park, Hsinchu, Taiwan R.O.C. 300-77, as evidenced by an assignment recorded April 8, 2004 at reel/frame 015195/0080.

**II. RELATED APPEALS AND INTERFERENCES**

There are no related appeals or interferences.

### **III. STATUS OF THE CLAIMS**

Claims 1-3, 6, 8-10, 13, 15-17, and 20 are pending in this application and all of these pending claims were rejected by the FINAL Office Action mailed December 8, 2008, and are the subject of this appeal. Claims 4-5, 7, 11-12, 14, and 18-19 were cancelled during the prosecution of this application and are not under appeal.

### **IV. STATUS OF AMENDMENTS**

No amendments have been submitted since the FINAL Office Action mailed December 8, 2008, and all previously-submitted amendments have been entered. The claim listing in section VIII. CLAIMS – APPENDIX (below) represents the present state of the claims.

### **V. SUMMARY OF THE CLAIMED SUBJECT MATTER**

Embodiments of the claimed subject matter are summarized below with reference numbers and references to the specification and drawings. The subject matter described below appears in the original disclosure at least where indicated, and may further appear in other places within the original disclosure.

Embodiments of the invention, such as those defined by claim 1, a process scheduling system (see e.g., p. 12, line 5, and reference number 100 of FIG. 1) to schedule processes on an application system, comprising: a plurality of configurations (see FIG. 1, reference number 101 and related description, including p. 5, line 6). comprising at least one resource item (see FIG. 1, reference number 110 and related description, including p. 5, line 8) and at least one process (see FIG. 1, reference number 120 and related description, including p. 5, line 13) of the application system, wherein the resource item comprises a central processing unit (CPU) (p. 5, line 19) and a disk of the application system; a fetch module (see FIG. 1, reference number 102 and related description, including p. 5, line 7) to fetch resource

status data of the resource item, wherein the resource status data comprises data for the CPU use rate and data for the disk use rate (see e.g., p. 6, line 5); a timing scheduling module (see FIG. 1, reference number 103 and related description, including p. 6, line 6) to use a neural network model to determine an execution time point (see p. 7, last line to p. 8, first line) for the process according to the resource status data, wherein the CPU use rate, the disk use rate and a peak time interval are adopted as processing elements of the neural network model (p. 10, lines 15-20), and the resource status data is fed to the neural network model for calculating the execution time point for the process; and a trigger module (see FIG. 1, reference number 104 and related description, including p. 6, line 10) to determine whether the execution time point for the process is present (p. 6, lines 5-11), and execute the process at the execution time point when the execution time point for the process is present (see e.g., p. 12, lines 4-10).

Embodiments of the invention, such as those defined by claim 8, a process scheduling method to schedule processes on an application system, comprising the steps of: fetching resource status data of at least one resource item of the application system (see FIG. 3, reference number S301 and related description, including p. 7, lines 1-5), wherein the resource item comprises a central processing unit (CPU) (p. 5, line 19) and a disk of the application system, and the resource status data comprises data for the CPU use rate and data for the disk use rate (see e.g., p. 6, line 5); determining an execution time point for at least one process according to the resource status data using a neural network model, wherein the CPU use rate, the disk use rate and a peak time interval are adopted as processing elements of the neural network model (p. 10, lines 15-20), and the resource status data is fed to the neural network model for calculating the execution time point for the process; determining whether the execution time point for the process is present (p. 6, lines 5-11); and when the execution time point for the

process is present (see FIG. 4, reference number S402, and related description, including p. 7, line 17 through p. 8, line 2), executing the process at the execution time point.

Embodiments of the invention, such as those defined by claim 15, a machine-readable storage medium storing a computer program (see FIG. 6 and related description) which, when executed, directs a computer to perform a process scheduling method to schedule processes on an application system, comprising the steps of: fetching resource status data of at least one resource item of the application system (see FIG. 6, reference number 611, and related description, including p. 12, line 17), wherein the resource item comprises a central processing unit (CPU) (p. 5, line 19) and a disk of the application system, and the resource status data comprises data for the CPU use rate and data for the disk use rate (see e.g., p. 6, line 5); determining an execution time point for at least one process according to the resource status data using a neural network model (see FIG. 6, reference number 612, and related description, including p. 12, line 19), wherein the CPU use rate, the disk use rate and a peak time interval are adopted as processing elements of the neural network model (p. 10, lines 15-20), and the resource status data is fed to the neural network model for calculating the execution time point for the process; determining whether the execution time point for the process is present (p. 6, lines 5-11); and when the execution time point for the process is present (see e.g., p. 12, lines 4-10), executing the process at the execution time point.

## **VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**

The following grounds of rejection are to be reviewed on appeal.

The FINAL Office Action rejected claims 1, 3, 6, 8, 10, 13, 15, 17 and 20 under 35 U.S.C 103(a) as being unpatentable over Butt et al. (U.S. Pat. No. 5,889,944) in view of Yamagashi (U.S. Pat. No. 5,870,604), Aref et al. (U.S. Pat. No. 6,023,720), and Bigus (U.S. Pat. No. 5,442,730).

## **VII. ARGUMENT**

**The FINAL Office Action rejected claims 1, 3, 6, 8, 10, 13, 15, 17 and 20 under 35 U.S.C 103(a) as being unpatentable over Butt et al. in view of Yamagashi, Aref et al., and Bigus**

The FINAL Office Action rejected claims 1, 3, 6, 8, 10, 13, 15, 17 and 20 under 35 U.S.C 103(a) as being unpatentable over Butt et al. in view of Yamagashi, Aref et al., and Bigus. For at least the reasons set forth herein, Applicant submits that these rejections should be overturned.

Independent claim 1 recites:

1. A process scheduling system to schedule processes on an application system, comprising:
  - a plurality of configurations comprising at least one resource item and at least one process of the application system, wherein the resource item comprises a central processing unit (CPU) and a disk of the application system;
  - a fetch module to fetch resource status data of the resource item, wherein the resource status data comprises data for the CPU use rate and data for the disk use rate;
  - a timing scheduling module to use a neural network model to ***determine an execution time point*** for the process according to the resource status data, ***wherein the CPU use rate, the disk use rate and a peak time interval are adopted as processing elements of the neural network model***, and the resource status data is fed to the neural network model for calculating the execution time point for the process; and
  - a trigger module to ***determine whether the execution time point for the process is present***, and execute the

process at the execution time point when the execution time point for the process is present.

(*Emphasis Added*). Claim 1 patently defines over the cited art for at least the reason that the cited art fails to disclose the features emphasized above.

In the Final Office Action, the Examiner asserts that the claimed feature of ***determining an execution time point*** for at least one process according to the resource status data has been disclosed by Butt. Applicant respectfully disagrees. In the claimed invention, **a time point is actually determined for the process**. Col. 4, lines 44-51 of the Butt reference states: "If the resource is not free, in a step S12, the job is placed on a queue (the holding queue) of **jobs which are waiting for a resource to become free**. Some jobs are scheduled for execution **at a later time**. If it is found in step S11 that the resource is free, in a step S13 a check is made to determine if the job is scheduled for execution at a later time." **No time point is determined in the Butt reference. Instead, the execution of jobs depends on whether the resource is free or not. Nowhere in the Butt reference does it disclose the claimed feature of "determining an execution time point for at least one process"**. For at least this reason, the rejection of claim 1 should be overturned.

In the Final Office Action, the Examiner also asserts that the claimed feature of *determining whether the execution time point for the process is present, and when the execution time point for the process is present, executing the process at the execution time point* have been disclosed by Butt. Again, Applicant respectfully disagrees. As described, in the claimed invention, a time point is calculated for the process. **The trigger module only needs to check timer and determine whether the determined execution time point is present, and trigger the process to be executed when the**

**determined execution time point is present.** Col.4, lines 21-22 of the Butt reference states: “If a job can be executed immediately, it is passed to the module SMAN, which loads it on to a server”. This does not teach the claimed feature, but only relevantly teaches that when the job can be executed, it can be loaded to the server for execution. It is understood that, in the Butt reference, that ***the status of the resource must be always monitored to determine whether the resource is free or not.*** If the resource is free, the job can be executed. Simply stated, these teachings are different from the claimed invention, and **nowhere in the Butt reference does it disclose the claimed feature of “determining whether the execution time point for the process is present, and when the execution time point for the process is present, executing the process at the execution time point”.** For at least this additional reason, the rejection of claim 1 should be withdrawn.

Further still, in Final Office Action, the Examiner asserts that Bigus teaches the use of a neural network model for timing which runs outside a peak time interval. Applicant respectfully disagrees. In the application, ***the scheduling of a process on an application system is optimized under the general limited factors.*** In the claimed invention, ***the CPU use rate, the disk use rate and a peak time interval are inputs (parameters) of the neural network for calculating the execution time point of a process.*** As explained in previous responses filed in this application, ***Bigus discloses a neural network used for job schedule.*** No more detail is discussed in the Bigus reference. In the Bigus reference, Figs. 6A and 6B illustrate steps required to construct a delay cost function. Col.8, lines 45-47 of the Bigus reference states “Since the training steps of FIGS. 6A and 6B may be performed at any arbitrary time, training may

be deferred to a time when computer system 100 is not busy.” It is clear that **Bigus** only teaches that the training steps of FIGS. 6A and 6B can be performed *when computer system 100 is not busy*. *The parameter of “when computer system is not busy” or “the time where computer system is not busy” is not used to calculate the scheduling result, such as the execution time point as claimed.* *Nowhere in the Bigus reference does it disclose or teach the resource status data (CPU use rate and the disk use rate) and the peak time interval of the application system can be integrated to the neural network for job scheduling.* For at least this additional reason, the rejection of claim 1 should be withdrawn.

Further still, claim 1 recites features of: “wherein the resource item comprises a central processing unit (CPU) and a disk of the application system, and *the resource status data comprises data for the CPU use rate and **data for the disk use rate***”. In Final Office Action, the Examiner asserts that “It would have been obvious to one ordinary skill in the art at the time the invention was made to combine the teaching of Aref with that of Butt and Yamagashi, as the **disk i/o throughput** can have a large effect on system performance. Applicant respectfully disagrees. *The term “disk use rate” of the claimed invention cannot be patentably equated to the disk i/o throughput* asserted by the Examiner. In the claimed embodiment, *the resource item comprises a central processing unit and a disk of the application system, and the resource status data comprises data for the CPU use rate and data for the disk use rate*. As previously explained in the prosecution of this application, *“disk use rate” means the occupation situation of the disc. The occupation situation of the disc may be a ratio relative to the total size of the disc. The disk i/o throughput,*



***however, is the input/output quantity of the disc relative to a time unit, which is patentably different from the claimed invention.***

Additionally, col. 5, lines 26-35 of the Aref reference states: “This solution has been found to have several drawbacks. First, *batching a large number of writes to increase the disk bandwidth utilization* (by reducing seek time) may lead to either an increased likelihood of the system violating the deadline of newly arrived read requests or starvation of the write requests. Also, *interrupting the SCAN order of currently existing reads to schedule writes may increase the average seek time and lower disk utilization*. This increases the overall delay of read requests at the server, leading to a reduction in QOS, as observed by the application.” It is clear that, Aref introduces batching a large number of writes will increase the disk bandwidth utilization, and interrupting the SCAN order of currently existing reads to schedule writes may lower disk utilization. *Aref only relevantly introduces the basic concept and results on the disk and bandwidth thereof when applying reads/writes to a disc. The objective of the Aref reference is to support simultaneous read and write requests in the presence of real-time requirements and high bandwidth demands. Various embodiments of the invention dynamically calculate an execution time point for a process according to the resource status of the resource item, which is patentably distinguished from the Aref reference. Nowhere in the Aref reference does it disclose that the disk situation (disk use rate) can be used to schedule a process.*

Consequently, Applicant respectfully submits that neither Butt, Yamagashi, Aref, nor Bigus teaches or suggests that the claimed features of “**determining *an execution time point* for at least one process according to the resource status data using a neural**

*network model, wherein the CPU use rate, the disk use rate and a peak time interval are adopted as processing elements of the neural network model*, and the resource status data is fed to the neural network model for calculating the execution time point for the process” and “*determining whether the execution time point for the process is present, and when the execution time point for the process is present, executing the process at the execution time point*”. Accordingly, Applicant respectively submits that the rejection of claim 1 is deficient and should be overturned.

Independent claims 8 and 15 patently define over the cited art for the same reasons. In this regard, claims 8 and 15 embody features similar to the defining features of claim 1. Specifically, claims 8 and 15 recite:

8. A process scheduling method to schedule processes on an application system, comprising the steps of:  
fetching resource status data of at least one resource item of the application system, wherein the resource item comprises a central processing unit (CPU) and a disk of the application system, and the resource status data comprises data for the CPU use rate and data for the disk use rate;  
***determining an execution time point*** for at least one process according to the resource status data using a neural network model, ***wherein the CPU use rate, the disk use rate and a peak time interval are adopted as processing elements of the neural network model***, and the resource status data is fed to the neural network model for calculating the execution time point for the process;  
***determining whether the execution time point for the process is present***; and  
when the execution time point for the process is present, executing the process at the execution time point.

15. A machine-readable storage medium storing a computer program which, when executed, directs a computer to perform a process scheduling method to schedule processes on an application system, comprising the steps of:

fetching resource status data of at least one resource item of the application system, wherein the resource item comprises a central processing unit (CPU) and a disk of the application system, and the resource status data comprises data for the CPU use rate and data for the disk use rate;

***determining an execution time point*** for at least one process according to the resource status data using a neural network model, ***wherein the CPU use rate, the disk use rate and a peak time interval are adopted as processing elements of the neural network model***, and the resource status data is fed to the neural network model for calculating the execution time point for the process;

***determining whether the execution time point for the process is present***; and

when the execution time point for the process is present, executing the process at the execution time point.

(*Emphasis Added*). Claims 8 and 15 patently define over the cited art for at least the reason that the cited art fails to disclose the features emphasized above. Again, the features emphasized in claims 8 and 15 above parallel the distinguishing features of claim 1. Therefore, the rejections of claims 8 and 15 should be overturned for the same reasons presented above in connection with claim 1.

As a separate and independent basis for the patentability of all claims, Applicant submits that the tenuous combination of Butt, Yamagashi, Aref, and Bigus is improper and therefore does not render the claims obvious. In this regard, the Office Action combined Yamagashi with But on the solely expressed basis that “it would have been obvious ... [because] polling the CPU use rate would be vital to a process scheduling method due to the CPU’s inherent importance in processing data.” (see e.g., FINAL Office Action, p. 3). The Office Action then further combined Aref on the solely expressed basis that “it would have been obvious ... as the disk i/o throughput can have a large effect on system performance.” (FINAL Office Action, p. 4). The Office Action

then further combined Bigus on the solely expressed basis that “it would have been obvious ... as a neural network model offers dynamic adaptability to actual system conditions instead of a static model that must be manually adjusted by system administrators.” (FINAL Office Action, p. 4).

These rationales are both incomplete and improper in view of the established standards for rejections under 35 U.S.C. § 103.

In this regard, the MPEP section 2141 states:

The Supreme Court in KSR reaffirmed the familiar framework for determining obviousness as set forth in *Graham v. John Deere Co.* (383 U.S. 1, 148 USPQ 459 (1966))... As reiterated by the Supreme Court in KSR, the framework for the objective analysis for determining obviousness under 35 U.S.C. 103 is stated in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966). Obviousness is a question of law based on underlying factual inquiries. The factual inquiries enunciated by the Court are as follows:

- (A) Ascertaining the differences between the claimed invention and the prior art; and
- (B) Ascertaining the differences between the claimed invention and the prior art; and
- (C) Resolving the level of ordinary skill in the pertinent art.

In addition:

When applying 35 U.S.C. 103, the following tenets of patent law must be adhered to:

- (A) The claimed invention must be considered as a whole;
- (B) The references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination;
- (C) The references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention and
- (D) Reasonable expectation of success is the standard with which obviousness is determined.

*Hodosh v. Block Drug Co., Inc.*, 786 F.2d 1136, 1143 n.5, 229 USPQ 182, 187 n.5 (Fed. Cir. 1986).

As reflected above, the foregoing approach to obviousness determinations was recently confirmed by the United States Supreme Court decision in KSR INTERNATIONAL CO. V. TELEFLEX INC. ET AL. 550 U.S. 1, 82 USPQ2d 1385, 1395-97 (2007), where the Court stated:

In *Graham v. John Deere Co. of Kansas City*, 383 U. S. 1 (1966), the Court set out a framework for applying the statutory language of §103, language itself based on the logic of the earlier decision in *Hotchkiss v. Greenwood*, 11 How. 248 (1851), and its progeny. See 383 U. S., at 15–17. The analysis is objective:

“Under §103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented.” *Id.*, at 17–18.

Indeed, as now expressly embodied in MPEP 2143, “[t]he **key to supporting any rejection under 35 U.S.C. 103 is the clear articulation of the reason(s) why the claimed invention would have been obvious**. The Supreme Court in KSR noted that the analysis supporting a rejection under 35 U.S.C. 103 should be made explicit.” (*Emphasis added, MPEP 2143*). “Objective evidence relevant to the issue of obviousness **must** be evaluated by Office personnel.” (MPEP 2141). “The key to supporting any rejection under 35 U.S.C. 103 is the **clear articulation of the reason(s)** why the claimed invention would have been obvious. The Supreme Court in KSR noted that the analysis supporting a rejection under 35 U.S.C. 103 **should be made explicit**. The Court quoting *In re Kahn*, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006), stated that ‘[R]ejections on obviousness cannot be sustained by mere conclusory

statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” (MPEP 2141).

Simply stated, the Office Action has failed to at least (1) ascertain the differences between and prior art and the claims in issue; and (2) resolve the level of ordinary skill in the art. Furthermore, the alleged rationale for combining the references is merely an improper conclusory statement that embodies clear and improper hindsight rationale. In short, the various rationales cited for supporting the tenuous combination of references amount to nothing more than subjective assessments of perceived positive qualities about a particular secondary reference, and not objective teachings motivating the combinations. In this regard, the same motivations cited by the FINAL Office Action could be used to support the combination of the secondary references with ANY other references. Clearly, this contradicts well established precedent with regard to rejections under 35 U.S.C. § 103.

For at least these additional reasons, Applicant submits that the rejections of all claims are improper and should be withdrawn.

For at least the foregoing reasons, independent claims 1, 8, and 15 patently define over the cited art and the rejections should be withdrawn. Insofar as all remaining claims depend from claim 1, claim 8, or claim 15, the rejections of all remaining claims should be overturned for the same reasons. *In re Fine*, 837 F.2d 1071, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988).

## **Conclusion**

For at least the reasons discussed above, Appellants respectfully request that the Examiner's final rejection of 1-3, 6, 8-10, 13, 15-17, and 20 be overturned by the Board, and that the application be allowed to issue as a patent with pending 1-3, 6, 8-10, 13, 15-17, and 20.

In addition to the claims listed in Section VIII (CLAIMS – APPENDIX), Section IX (EVIDENCE – APPENDIX) included herein indicates that there is no additional evidence relied upon by this brief. Section X (RELATED PROCEEDINGS – APPENDIX) included herein indicates that there are no related proceedings.

A credit card authorization is provided to cover the fee with the Appeal Brief. No additional fee is believed to be due. If any additional fee is due, you are authorized to charge any such fee to deposit account 20-0778.

Respectfully submitted,

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## **VIII. CLAIMS – APPENDIX**

1. A process scheduling system to schedule processes on an application system, comprising:

a plurality of configurations comprising at least one resource item and at least one process of the application system, wherein the resource item comprises a central processing unit (CPU) and a disk of the application system;

a fetch module to fetch resource status data of the resource item, wherein the resource status data comprises data for the CPU use rate and data for the disk use rate;

a timing scheduling module to use a neural network model to determine an execution time point for the process according to the resource status data, wherein the CPU use rate, the disk use rate and a peak time interval are adopted as processing elements of the neural network model, and the resource status data is fed to the neural network model for calculating the execution time point for the process; and

a trigger module to determine whether the execution time point for the process is present, and execute the process at the execution time point when the execution time point for the process is present.

2. The system of claim 1 wherein the configuration further comprises a fetch frequency, and according to which the fetch module fetches the resource status data.



3. The system of claim 1 wherein the resource status data for determination is within a predetermined reference range, wherein the predetermined reference range is a time interval, and the resource status data is fetched within the time interval.

4-5. (Cancelled).

6. The system of claim 1 wherein the fetch module further fetches the resource status data of the resource item as feedback for further determination after the process is executed.

7. (Cancelled).

8. A process scheduling method to schedule processes on an application system, comprising the steps of:

fetching resource status data of at least one resource item of the application

system, wherein the resource item comprises a central processing unit

(CPU) and a disk of the application system, and the resource status data

comprises data for the CPU use rate and data for the disk use rate;

determining an execution time point for at least one process according to the

resource status data using a neural network model, wherein the CPU use

rate, the disk use rate and a peak time interval are adopted as processing

elements of the neural network model, and the resource status data is fed

to the neural network model for calculating the execution time point for the process;

determining whether the execution time point for the process is present; and  
when the execution time point for the process is present, executing the process at the execution time point.

9. The method of claim 8 further comprising fetching the resource status data according to a fetch frequency.

10. The method of claim 8 further comprising determining the execution time point according to the resource status data within a predetermined reference range, wherein the predetermined reference range is a time interval, and the resource status data is fetched within the time interval.

11-12. (Cancelled).

13. The method of claim 8 further comprising fetching the resource status data of the resource item as feedback for further determination after the process is executed.

14. (Cancelled).

15. A machine-readable storage medium storing a computer program which, when executed, directs a computer to perform a process scheduling method to schedule processes on an application system, comprising the steps of:

fetching resource status data of at least one resource item of the application system, wherein the resource item comprises a central processing unit (CPU) and a disk of the application system, and the resource status data comprises data for the CPU use rate and data for the disk use rate;

determining an execution time point for at least one process according to the resource status data using a neural network model, wherein the CPU use rate, the disk use rate and a peak time interval are adopted as processing elements of the neural network model, and the resource status data is fed to the neural network model for calculating the execution time point for the process;

determining whether the execution time point for the process is present; and

when the execution time point for the process is present, executing the process at the execution time point.

16. The storage medium of claim 15, storing said computer program which, when executed, further directs the computer to perform the step of fetching the resource status data according to a fetch frequency.

17. The storage medium of claim 15, storing said computer program which, when executed, further directs the computer to perform the step of determining the execution

time point according to the resource status data within a predetermined reference range, wherein the predetermined reference range is a time interval, and the resource status data is fetched within the time interval.

18-19. (Cancelled).

20. The storage medium of claim 15, storing said computer program which, when executed, further directs the computer to perform the step of fetching the resource status data of the resource item as feedback for further determination after the process is executed.

## IX. EVIDENCE – APPENDIX

None.

**X. RELATED PROCEEDINGS – APPENDIX**

None.